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POPULATIONS STUDIES IN *DICHROMANTHUS* AND *HEXALECTRIS* IN SOUTHEASTERN ARIZONA

RONALD A. COLEMAN

University of Arizona, 11520 East Calle Del Valle, Tucson, AZ 85749 USA.
Email: ronorchid@cox.net

ABSTRACT. An interim report is presented on the population dynamics of *Dichromanthus michuacanus* and *Hexalectris revoluta* in southeastern Arizona. Several colonies of each species have been monitored annually to evaluate total number of plants appearing and blooming patterns. The objective of the study is to determine if plants appear every year; if plants bloom on successive years; length of time between blooming events for a given plant; and long-term population dynamics. As of 2003, the study has been ongoing for 9 years. Interim results indicate that plants from both species are unreliable bloomers in successive years. Blooming can stunt succeeding growth on *D. michuacanus,* and plants of *H. revoluta* do not even appear above ground for several years after blooming.

Key words: Conservation, McCleary Canyon, Pima County, Sawmill Canyon, Santa Cruz County, flowering patterns

INTRODUCTION

Arizona has 26 native orchid species in 13 genera. Of these, 14 species are considered rare in the state. The author is conducting multi-year studies on two of the 14 rare taxa to determine if plants appear every year; if plants bloom in successive years; the length of time between blooming events for a given plant; and long-term population dynamics. With the studies ongoing, partial results are reported here, with interim conclusions drawn at this stage. This paper updates Coleman (2001), presenting results through 2003 on *Dichromanthus michuacanus* (Llave & Lex.) Salazar et Soto Arenas and *Hexalectris revoluta* var. *colemanii* Catling.

TAXONOMIC TREATMENTS

Dichromanthus michuacanus (Llave & Lex.) Salazar et Soto Arenas, distributed widely in Mexico, is historically rare in the United States, occurring only in Big Bend National Park in Texas and in the southeastern Arizona counties of Cochise, Pima, and Santa Cruz. Most records refer to it as *Stenorrhynchos michuacanum* (Lexarza) Lindley, but Salazar et al. (2002) transferred it to the genus *Dichromanthus.* FIGURE 1A, B.

The plant blooms late September–late October on an inflorescence 25–58 cm tall, with 10–30 pale green flowers with dark green stripes on the sepals, petals, and lip. A blooming plant has 3 or 4 leaves 15–20+ cm long and up to 3 cm wide. It grows at 1500–2134 m elevation in Madrean evergreen woodland, primarily in association with alligator juniper (*Juniperus deppeana* Steud.). A common companion, essentially an indicator plant, is *Milla biflora.*

Hexalectris revoluta var. **colemanii** was described by Catling (2004) as endemic to southeastern Arizona. When this project began, the author treated this plant as *Hexalectris revoluta* Correll. It is known from only four areas in Arizona: Baboquivari Canyon, McCleary Canyon, Sawmill Canyon, and the Dragoon Mountains. The plant, originally discovered at the Baboquivari location, has not been observed there since, despite repeated searches. FIGURE 1C, D.

Hexalectris revoluta var. *colemanii* blooms late May–early June in canyon bottoms and on sides of canyons under oaks and mesquite, often in association with Arizona walnut. Like all members of *Hexalectris* Rafinesque, it is a mycotrophic plant that appears above ground only to bloom. Up to 20 tan-to-pinkish flowers appear on a slender spicate, sparsely flowered, pale-cream-to-tan, leafless stem 20–50+ cm in height. Each flower is ca. 2 cm × 2 cm. The sepals and petals, free and spreading, are rolled back along the outer third of their length to form a tight circle. The 3-lobed lip is whitish-tan to rose-tan. The lateral lobes have distinct purple veining. The central lobe has 5–7 raised purple ridges running its entire length, from near the column to the apex.

Although not currently a candidate for federal endangered species status, *Hexalectris revoluta* var. *colemanii* could well be considered for listing because of its rareness. The McCleary Canyon location recently was included within the boundaries of land considered for trade by the United States Department of Agriculture Forest

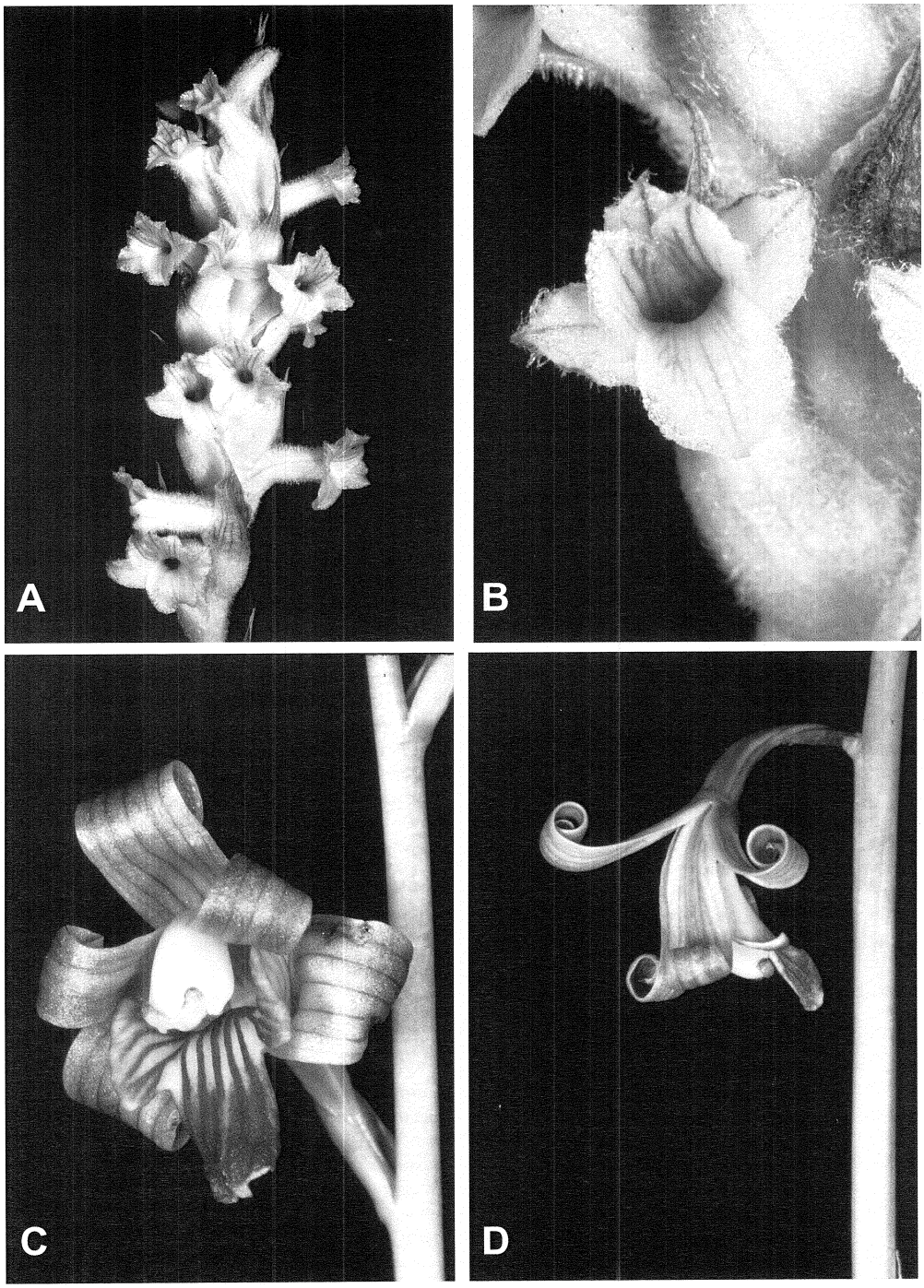

FIGURE 1. Arizona native orchids. **A.** *Dichromanthus michuacanus* flower spike. **B.** *Dichromanthus michuacanus* close-up. **C.** *Hexalectris revoluta* var. *colemanii* front view. **D.** *Hexalectris revoluta* var. *colemanii* side view. Photos by author.

TABLE 1. A blooming summary of *Dichromanthus michuacanus* at four study sites.

Site	Plants no.	Blooming plants no.	Total blooming attempts
Kansas Mine	16	3	5
Washington Camp	13	10	38
Scotia Canyon	9	7	7
Sycamore Canyon	14	14	36
Total	52	34	86

Service to a mining developer, but that trade is not currently under consideration.

METHODS AND RESULTS

Dichromanthus michuacanus

Staked and numbered plants of *Dichromanthus michuacanus* in four different colonies are being monitored each year at four locations. Referenced to local features, the study sites are Kansas Mine, Washington Camp, Scotia Canyon, and Sycamore Canyon. The plants are observed each year, often several times, and size and bloom status are recorded.

The survey, initiated in 1995 with 29 plants, was expanded to 52 plants in 1996, upon discovery of additional colonies. In the 9 years of the ongoing study, 34 plants have attempted blooming, with a total of 86 blooming attempts. A blooming attempt is defined as initiation of an inflorescence, which may or may not survive to maturity, primarily because of herbivory before anthesis.

TABLE 1 presents data by site. The number of plants that bloomed per year per site is shown in TABLE 2. About 52% of the plants that attempted blooming in one year also tried to flower the following year, as shown in TABLE 3. Plants that do not bloom the following year are often reduced in size to 1 or 2 leaves less than 10 cm in length. TABLE 4 shows frequency of blooming. In the 9-year study, half of the plants have bloomed only once or twice. No plants have bloomed every year. Only one plant has attempted blooming six times. TABLE 5 shows the history of consecutive blooming events. The most common event is for a plant to bloom for only 1 year and then rest, with 30 blooming events following this pattern. On 12 occasions, plants have bloomed 2 years in a row, and on five occasions, 3 years in a row. The single plant that has bloomed 6 years in a row bloomed for the sixth time in 2003, the most recent survey, and hence has the potential to bloom again in 2004.

TABLE 3. Total repeated blooming rate of *Dichromanthus michuacanus.*

Year	Attempting bloom	Attempting repeat bloom in next year	
	No.	No.	%
1996	20	6	30
1997	8	4	50
1998	12	5	42
1999	10	4	40
2000	6	5	83
2001	10	6	60
2002	10	6	60
2003	10		
Average	—	—	52

Gaps between blooming attempts are as great as 7 years, as one plant bloomed only in 1996. *Dichromanthus michuacanus* apparently can survive entirely underground for at least 2 years. A total of 13 plants have reappeared after not being observed for 1 or 2 years. Usually the first appearance, after missing a year above ground, is a small plant, but plant #3 at Sycamore Canyon bloomed after being dormant for a year. Five plants may have died during the survey period, as they have not been seen for 5 or more years.

Hexalectris revoluta var. *colemanii*

Observations of *Hexalectris revoluta* var. *colemanii* at two sites have been conducted yearly beginning in 1996. The sites are McCleary Canyon in Pima County and Sawmill Canyon in Santa Cruz County. No attempt was made to

TABLE 2. Annual blooming records for *Dichromanthus michuacanus* at four sites.

Site	1995	1996	1997	1998	1999	2000	2001	2002	2003
Scotia Canyon*		6	0	0	0	0	0	0	2
Washington Camp	3	0	2	4	8	4	8	5	5
Sycamore Canyon*		14	6	7	2	0	1	5	3
Kansas Mine	0	0	0	1	0	2	1	0	0
Total	3	20	8	12	10	6	10	10	10

* Sites not added to survey until 1996.

TABLE 4. Frequency of blooming in *Dichromanthus michuacanus.*

Blooming frequency/plant	Blooming plants no.
Once in study yrs	13
Twice	4
3 times	9
4 times	2
5 times	5
6 times	1
Total	34

TABLE 5. Consecutive blooming years for *Dichromanthus michuacanus.*

Blooming years no.	Blooming plants no.	
	Single yr	Consecutive yrs
Once only	30	—
2 yrs in a row		12
3 yrs in a row		5
4 yrs in a row		1
5 yrs in a row		1
6 yrs in a row		1

stake and number individual plants as with *Dichromanthus michuacanus.* From repeated observations of the mycotrophic genera *Hexalectris* and *Corallorhiza,* the author was aware that plants often do not reappear for several years after blooming. Instead, for this survey, the boundaries of the colonies were defined, and a search pattern is repeated each year counting the plants within the boundaries.

The number of plants appearing above ground fluctuates widely from year to year as shown in TABLE 6. As many as 40 plants have appeared at a single site, with a combined maximum of 51 plants at both sites. No plants appeared above ground at Sawmill Canyon in 2000, and no plants appeared above ground at either site in 2002. Both sites rebounded strongly in 2003.

As rainfall may be a factor in determining the quantity of blooming plants, historical data from the Western Regional Climate Center (2004) were used. Although the orchid colonies were not near the WRCC reporting locales, the five rainfall collection centers closest to the orchid colonies were surveyed. These were Coronado National Monument, Canelo 1 NW, Tucson 17 NW, Santa Rita Experimental Range, and Sierra Vista.

The yearly precipitation in Arizona falls in two main seasons: the winter rains and the summer monsoon rains. The monsoon rainy season begins usually between mid-June and early July and lasts until mid-September. The available data were in monthly totals by year, so the summer rains were counted as June–September, and for simplicity, the winter rains were October–May. Blooming at both study sites was summed to yield a yearly total and plotted against winter and summer rains at all five rainfall collection centers. As these centers had similar rainfall patterns, the overall pattern is concluded to be representative of that at the orchid colonies. A typical pattern is shown in FIGURE 2, which plots

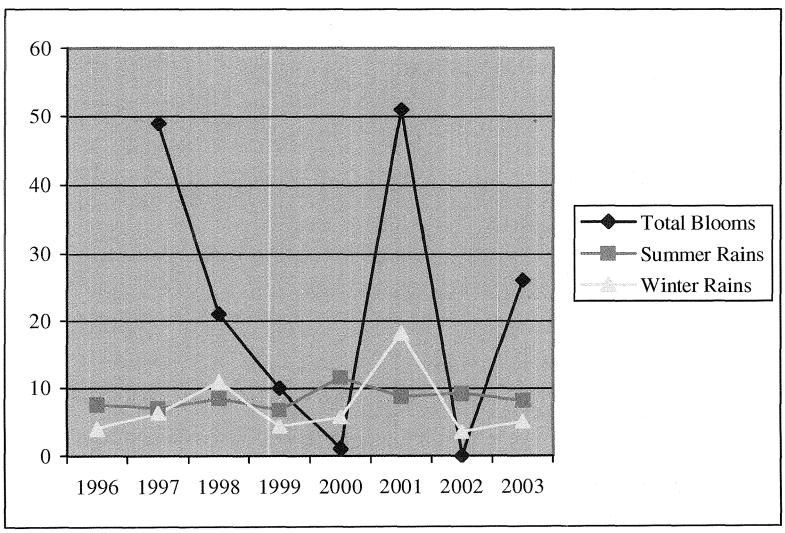

FIGURE 2. Blooming vs. rainfall (inches) at Canelo 1 NW rainfall collection center in Arizona.

TABLE 6. Blooming patterns of *Hexalectris revoluta* var. *colemanii* at two sites in Arizona.

	Year							
Site	1996	1997	1998	1999	2000	2001	2002	2003
Site 1 Rosemont	1	19	9	2	1	40	0	12
Site 2 Garner Canyon		30	12	8	0	11	0	14

Note: Site 2 not found until 1997.

data for Canelo 1 NW. Summer rains have been fairly constant during the years of this study, but winter rains vary widely and closely track the variation in blooming for *Hexalectris revoluta* var. *colemanii.*

FIGURE 2 data also suggest that the number of blooming plants drops precipitously after high bloom years. In 1998, only 21 plants bloomed, down from 49 in 1997; and after 51 plants bloomed in 2001, not a single plant appeared to bloom in 2002. Because of the small data set and rainfall pattern, however, it is not clear if these are independent events.

The initial assumption for the *Hexalectris revoluta* var. *colemanii* survey, that individual plants did not need to be marked, has been supported by observations. Only one plant, with certainty, has appeared twice in the survey. This lone plant, which grows on a small ledge in a rock outcrop, was observed in 1997 and again in 2003. At Rosemont in 2001, a group of 15 blooming plants appeared where none had been observed in 5 previous years, and no plants have appeared at that location since. Two groups of plants observed in 1997 at the lower canyon end of the Rosemont boundary have not appeared since.

CONCLUSIONS

Interim results of the 9-year, ongoing study indicate that plants from both study species are unreliable bloomers in successive years. Blooming can stunt succeeding growth on *Dichromanthus michuacanus,* and plants of *Hexalectris revoluta* do not even appear above ground for several years after blooming. Such results have implications for orchid management and conservation.

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